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Atlantic City International Airport,
N.J. 08405

Test and Evaluation Report for the Manual Domestic Passive Profiling System (MDPPS)

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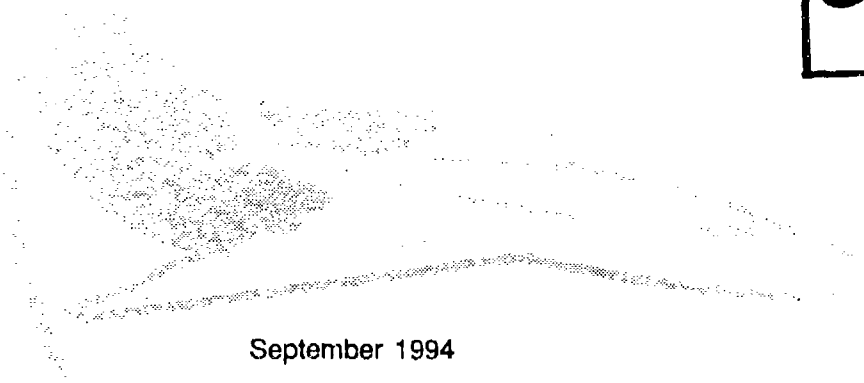

September 1994

Final Report

U S Department of Transportation
Federal Aviation Administration

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16 Abstract

The results presented in this report are a compilation of data collected at Northwest Airlines terminal, General Mitchell International Airport, Milwaukee, Wisconsin, from February 22-24, 1994. The study was conducted in support of the Aviation Security Human Factors Research Program located at the Federal Aviation Administration Technical Center (FAATC), Atlantic City International Airport, New Jersey.

Real-time (e.g., at the ticket counter and gate) passenger profiling was conducted February 22-24, 1994 in Milwaukee, Wisconsin. Passengers on twenty-one Northwest Airline flights were profiled according to parameters set forth by the Passenger Profiling Subject Matter Expert panel. One hundred ten passengers (82.7%) were cleared by the profile; twenty-three (17.3%) were not cleared. The mean time to profile was 1 minute 23 seconds. An ANalysis of VAriance (ANOVA) and a subsequent Least Square Difference (LSD) multiple comparison showed it took significantly longer to profile passengers who were not cleared (mean = 1 minute 27 seconds) than to profile passengers who were cleared (mean = 1 minute 9 seconds) [$F(131, 1) = 36.87$, $p = .000$].

Interview and anecdotal data are also summarized in the report.

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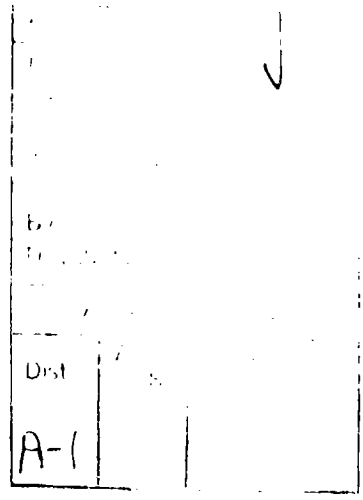
PREFACE

This document contains a compilation of data collected at Northwest Airlines terminal, General Mitchell International Airport, Milwaukee, Wisconsin from February 22-24, 1994. The study was conducted in support of the Aviation Security Human Factors Research Program located at the Federal Aviation Administration Technical Center (FAATC), Atlantic City International Airport, New Jersey. The key Federal Aviation Administration (FAA) personnel supporting this testing effort were J. L. Fobes, Ph.D., Aviation Security Human Factors Program Manager, and Ronald J. Lofaro, Ph.D. Both are Engineering Research Psychologists of the Aviation Security Research and Development Service.

Galaxy Scientific Corporation (GSC) prepared this document under Contract number DTFA03-02-C-00035 with the FAA Technical Center (FAATC). The Program Manager at Galaxy Scientific Corporation is William Hassler, Jr. The authors of this document are Jack Berkowitz, Nancy Dolan, and Douglas Fischer.



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LIST OF ABBREVIATIONS AND SYMBOLS

ACA	Aviation Security Research and Development Service
ACI	Office of Civil Aviation Security Intelligence
ACP	Office of Civil Aviation Security Policy and Planning
ACS	Assistant Administration for Civil Aviation Security
ANOVA	ANalysis Of VAriance
APS	Automated Profiling System
CRS	Customer Reservation System
FAA	Federal Aviation Administration
FAATC	Federal Aviation Administration Technical Center
FBI	Federal Bureau of Investigation
INS	Immigration and Naturalization Service
IOT&E	Initial Operational Test and Evaluation
LSD	Least Square Difference
MDPPS	Manual Domestic Passive Profiling System
MNS	Mission Need Statement
OT&E	Operational Test and Evaluation
PNR	Passenger Name Record
RAPS	Risk Assessment Profile System
RPI	Research Project Initiative
SME	Subject-Matter Expert
T&E	Test and Evaluation
TEP	Test and Evaluation Plan
TWA	TransWorld Airlines

EXECUTIVE SUMMARY

The Initial Operational Test and Evaluation (IOT&E) of the Manual Domestic Passive Profiling System (MDPPS) evaluated the feasibility of using a manual method of profiling passengers to determine which passengers did not require special security attention. This summary provides an overall review of the results of the IOT&E and the conclusions drawn from these results.

Increases in threat conditions can result in a requirement for additional security precautions at airports. These precautions are often resource intensive for the airlines. The cost of additional airport security systems, however, could be reduced if the number of passengers needing special security measures was minimized. This report discusses the results of increasing airport security by manually evaluating passenger "profiles" to identify domestic travelers thought not to represent a threat.

A panel of multi-agency Subject-Matter Experts (SMEs) was convened to review available data and determine which, if any, were applicable to passenger profiling. In addition, the SME panel was tasked with developing a weighting mechanism and decision rule for passenger clearance.

A manual domestic profiling worksheet was developed and operationally tested at the Northwest Airlines terminal in General Mitchell International Airport, Milwaukee, Wisconsin. This testing involved real-time data collection by Northwest employees on Northwest flight passengers and off-line data collection by the research team.

The MDPPS received input data from Northwest's Passenger Name Record (PNR). Data were manually entered on an evaluation/rating sheet and then evaluated by the specified methodology developed. The outcome was an MDPPS score, identifying whether passengers on a domestic flight require additional special screening. Those not eliminated would be candidates for a positive baggage match, x-ray of their checked baggage, and/or interrogatory intervention.

The MDPPS IOT&E was conducted in two phases. The first phase, the SME panel, was held at Galaxy Scientific Corporation, in Alexandria, Virginia. The instrument testing was conducted at the Northwest terminal in General Mitchell International Airport, Milwaukee, Wisconsin, from February 22 to 25, 1994, using Northwest employees and passengers.

The operational test profiled 133 passengers in real-time while 228 passengers were profiled in an "off-line" setting.

The validation of data elements, operational Issue 1, was addressed using data collected from the SME panel. Issue 2, percentage of passengers eliminated, was addressed using data collected during IOT&E at Milwaukee Airport. Northwest provided financial data to address Issue 3, resource requirements.

a. Issue 1. Do airlines' Customer Reservation System (CRS) databases contain information elements appropriate for judging passengers not to be a threat on domestic flights?

The airlines' CRS databases contain information elements thought to be appropriate for identifying passengers that do not require additional security measures for domestic flights.

A one-page passenger profiling worksheet was developed from the discussions and recommendations of the SME panel. This worksheet contained 35 data elements, grouped into nine categories. Twenty-eight of the data elements contributed to a cleared score, while the remaining seven contributed to a not-cleared score. Any of five particular data elements automatically cleared a passenger (i.e., the passenger needed no additional special security treatment).

A scale of +5 to -5 was used to weigh most data elements. Positive scores contributed to the cleared score, while negative scores contributed to the not-cleared score. The score with the greater value indicated whether a passenger cleared or not (i.e., passengers with a higher positive score cleared and did not clear when the higher score was negative).

The scoring of the MDPPS resulted in four possible outcomes. Passengers could be either automatically cleared or cleared by merit. Auto-cleared passengers were cleared based on a single data element. Passengers cleared by merit were cleared based on their score from the series of data elements. Passengers could also be not-cleared by merit, or possibly due to a lack of information.

b. Issue 2. Does the profiling system eliminate most domestic passengers from requiring special security treatment?

The MDPPS successfully cleared most passengers (i.e., eliminated them from requiring additional security measures).

1. Real-Time Data. One hundred thirty-three passengers were profiled in real-time as they checked in for their flight. Of these, 113 or 85.0 percent were cleared (average time of 72 seconds), and 20 or 15.0 percent were not-cleared (average time of 145 seconds).

Seventeen of the real-time passengers were auto-cleared (12.8 percent of the total passengers profiled real-time, 15 percent of the passengers cleared real-time). One hundred sixteen passengers were not auto-cleared.

2. Off-line Data. 228 passengers were profiled off-line. Of these, 113 passengers (49.6%) were cleared, and 115 passengers (50.4%) were not cleared. 24 of the cleared passengers were auto-cleared (10.5% of the number of people profiled off-line; 21.2% of the passengers cleared off-line).

121 of the passengers profiled off-line were profiled using a combination of PNRs and ticket lifts, with the remaining of 107 passengers profiled using only the PNR data. For the 121 passengers in the "PNR & Ticket-Lift" condition, 82 were cleared (67.8% of the "PNR & Ticket-Lift" passengers). For the 107 passengers in the "PNR only" condition, 31 were cleared (29.0% of the "PNR only passengers"). The availability and use of ticket lifts significantly affected the clearance decision.

The mean time to profile the "PNR & Ticket-Lift" passengers was 44.7 seconds. The 107 "PNR only" passengers had a mean time to profile of 33.8 seconds. Thus the time to utilize the ticket lift, which yields a higher clearance rate, is approximately 11 seconds. In addition, it took approximately 5 seconds longer to reach clearance decisions than non-clearance decisions in both the "PNR & Ticket-Lift" and "PNR only" conditions.

c. Issue 3. Does the domestic passenger profiling system require excessive resource requirements?

An examination of the time required to profile each passenger, and the associated direct and indirect costs provided by Northwest, indicates that resource requirements are large enough to deserve consideration. However, it is apparent that computer automated passive profiling is a viable alternative for larger cost reduction.

1. Real-Time Data. The average time to profile a passenger in real-time was 83 seconds.

2. Off-Line Data. The average time to profile a passenger off-line was 36.7 seconds for both "PNR only" and "PNR & Ticket-Lift" conditions. It took longer, by approximately 11 seconds, to reach a clearance decision when ticket lifts were additionally used (33.8 seconds for "PNR Only" versus 44.7 seconds for "PNR & Ticket-Lift").

3. Cost Data provided by Northwest Airlines. Northwest Airlines identified MDPPS resource requirements to include the following in 1993 U.S. dollars. These first year, start-up costs were calculated under the assumption that profiling would take two minutes or less.

(a) Resources Related to Airline Personnel: $9,029,700

(b) Resources Related to Non-Airline Personnel (Security screeners): $3,240,000

(c) Resources Relating to Indirect Factors: $1,978,275

(d) Based on Northwest's domestic enplanements in 1993 (36, 510, 878), the *additional* cost to manually profile each passenger is $0.39/passenger for the first year and $0.34/passenger thereafter.

This evaluation found that the number of variables used for profiling can be reduced with minimal decrease in percentage cleared. A re-configured profiling worksheet would shorten the time to profile resulting in an improved cost-benefit ratio. Additional data should be collected in a Follow-on OT&E to determine the resulting time to profile with reduced variables.

1. INTRODUCTION.

1.1 PURPOSE.

The purpose of this report is to present, explain, and discuss the results of the Initial Operational Test and Evaluation (IOT&E) of the Manual Domestic Passive Profiling System (MDPPS) conducted at the Northwest Airlines terminal, General Mitchell International Airport, Milwaukee, Wisconsin from February 22 to 25, 1994. The study was conducted in support of the Aviation Security Human Factors Research Program located at the Federal Aviation Administration Technical Center (FAATC), Atlantic City International Airport, New Jersey.

1.2 SCOPE.

The scope of this report is the presentation and interpretation of data analyses for each critical operational issue identified in the MDPPS Test and Evaluation Plan (TEP). A discussion of the conclusions and recommendations of the researchers is also included. The IOT&E did not address implementation issues and concerns; however, a brief overview of these is included at the end of this report.

1.3 BACKGROUND.

1.3.1 Program Background.

An increase in threat conditions could result in a requirement for additional domestic security precautions such as a positive passenger-bag match or x-ray inspection of all baggage. These precautions are resource intensive; however, their cost could be reduced if the number of passengers needing special security measures could be minimized. A program was initiated to investigate if this could be accomplished by applying a passenger "profile" to identify domestic travelers thought not to represent a terrorist threat.

The Office of Civil Aviation Security Policy and Planning (ACP) and the Office of Civil Aviation Security Intelligence (ACI) Federal Aviation Administration (FAA) headquarters elements of Assistant Administration for Civil Aviation Security (ACS) required the development and feasibility analysis of a method for manually profiling domestic passengers. The research conducted focused on profiling which is passive in that passengers are not directly queried. The technique featured information contained in the Customer Reservation System (CRS) as well as other relevant information readily available to the profiling airline agent. Scoring or profiling consisted of determining a mathematical score resulting from analysis of the combined data elements and their individual weighting factors.

This research was conducted by the Aviation Security Human Factors Program under Research Project Initiative (RPI) #129 in support of Mission Need Statement (MNS) #163.

1.3.2 Test and Evaluation (T&E) Background.

Profiles exist for detecting potential hijackers as well as terrorists on international flights. International profiling includes the Risk Assessment Profile System (RAPS) and Northwest has an experimental

version of an Automated Profiling System (APS) in development for international passengers. In contrast, the approach taken here for domestic passengers was to "clear" those judged not to be a threat as opposed to identifying threat individuals or "selectees."

Information currently available to airline employees (e.g., CRS, ticket lifts/stubs, and databases) was assessed by Subject-Matter Experts (SMEs) to determine which data elements were applicable to passenger profiling. These data elements were then weighted and a decision rule created. The resulting MDPPS instrument was field tested by having airline employees profile passengers in real-time and researchers profile off-line.

The focus was on using the profile score to eliminate low-risk passengers from additional special scrutiny (e.g., positive baggage matching, extensive baggage inspection).

1.4 SYSTEM DESCRIPTION.

The MDPPS evaluated data from Northwest's Passenger Name Record (PNR). This reservation system is also used by Delta Air Lines and TransWorld Airlines (TWA). Data were entered on a paper and pencil instrument (evaluation/rating sheet) and evaluated by the specified methodology developed. The outcome was a MDPPS score that identified passengers on a domestic flight who do not need additional special screening. Those not eliminated are candidates for a positive baggage match and interrogatory intervention.

1.5 OPERATIONAL ISSUES AND CRITERIA.

The following critical operational issues were tested and evaluated.

1.5.1 Issue 1.

Do airlines' CRS databases contain information elements appropriate for judging passengers not to be a threat on domestic flights?

a. Scope. Airline reservation systems contain data fields for information such as seat assignment, routing, etc. SMEs were provided with a list of this information from Northwest's PNR. The SMEs evaluated this information readily available to airline personnel and judged whether it can be expected to identify domestic passengers not needing special security measures.

b. Criteria.

1. Criterion 1-1. The SME panel will recommend particular information items to be used as factors in the MDPPS job aid.

2. Criterion 1-2. The SME panel will recommend the weighting of information items to be used as factors in the MDPPS job aid.

3. Criterion 1-3. The SME panel will recommend an algorithm/decision rule for using the information items, plus any necessary factor weightings, for using the decision rule.

c. Rationale. The use of a SME panel is essential to MDPPS because no objective method exists to determine and evaluate the validity of items used as factors in MDPPS's decision rule.

1.5.2 Issue 2.

Does the profiling system eliminate most domestic passengers from requiring special security treatment?

a. Scope. The aim of the MDPPS is to identify those passengers that do not require special security treatment. It is presumed that most of the passengers will fall into this category and the MDPPS should accordingly eliminate most passengers. The preliminary MDPPS developed was field tested to determine if an acceptable percentage of passengers are eliminated from further special treatment.

b. Criterion. None. This issue was investigative in nature.

c. Rationale. A study to determine the percentage of passengers eliminated from requiring additional special scrutiny was necessary to evaluate the practical effectiveness of the MDPPS. No basis exists for Aviation Security Research and Development Service (ACA) to select minimal clearance rates.

1.5.3 Issue 3.

Does the domestic passenger profiling system require excessive resource requirements?

a. Scope. The MDPPS is intended for potential implementation on all domestic flights. Airlines have limited financial and personnel resources, and the MDPPS should not unduly impact their resources by requiring excessive monetary and/or personnel commitments.

b. Criterion. None. This issue was investigative in nature.

c. Rationale. MDPPS implementation will directly affect resource allocation within airlines. The field test and evaluation of the MDPPS provided an opportunity to collect data regarding anticipated resource requirements and expenditures involved in supporting the system. No basis exists for ACA to select maximum cost.

1.6 EVALUATION APPROACH.

The SME panel was selected and assembled to consensually evaluate CRS information and suggest how to use this information to identify passengers not needing special screening. The SME panel (table 1) recommended particular information items that were used as factors in the MDPPS instrument. They also recommended the weighting of information items used and an algorithm/decision rule for using the information items. A research team developed the preliminary MDPPS instrument and field tested it to provide information to ACS for their determination of whether the percentage of passengers eliminated is acceptable given the associated cost.

TABLE 1. SUBJECT-MATTER EXPERTS

ORGANIZATION
AMERICAN AIRLINES SECURITY American Airlines, MD-5555 HQs 4333 Amon Carter Ft. Worth, TX 76155
CUSTOMS Room 4417, US Customs Service 1301 Constitution Ave, NW Washington, DC 20229
FAA ACI-200, FAA Headquarters 800 Independence Ave., SW Washington, DC 20591
FEDERAL BUREAU OF INVESTIGATION (FBI) FBI Academy Quantico, VA 22135
IMMIGRATION AND NATURALIZATION SERVICE (INS) 1212 Princess St. Alexandria, VA 22314
NORTHWEST AIRLINES SECURITY Northwest Airlines, Dept A4420 5101 Northwest Dr. St. Paul, MN 55111
UNITED AIRLINES SECURITY UAL EXOVS, POB 66100 Chicago, IL 60666
FACILITATORS:
FAATC Aviation Security Research and Development Service, Building 315, Atlantic City International Airport, NJ 08405
G/ LAXY SCIENTIFIC CORPORATION 2500 English Creek Avenue, Building 11, Pleasantville, NJ 08232

A research team collected data on the resource requirements for conducting the MDPPS. Resource requirements necessary to implement and support profiling, based on the time to profile and number of passengers profiled data, was supplied by Northwest.

1.7 TEST AND EVALUATION LIMITATIONS AND IMPACT.

1.7.1 Test Limitations and Impact.

There were no test limitations although weather-related flight cancellations reduced the number of passengers available for profiling.

1.7.2 Evaluation Limitations and Impact.

There were no evaluation limitations.

2. TEST DESCRIPTION.

2.1 TEST PURPOSE.

The IOT&E supported the evaluation of MDPPS operational effectiveness and suitability.

2.2 TEST OVERVIEW.

The first phase of the MDPPS IOT&E, and the SME panel was conducted to evaluate information readily available to airline personnel and judge whether it can be expected to identify domestic passengers not needing additional special security measures. The second phase, field data collection, was conducted to gather data to aid in determining if a manual domestic profiling instrument eliminates an acceptable percentage of passengers from additional special security measures, and if such a profile system unduly impacts airline resources by requiring excessive monetary and personnel commitments.

2.2.1 Phase 1 - SME.

The panel of SMEs were provided with the types of information from Northwest's PNR and were also given a list of reservation information proposed by ACI for domestic profiling. The SMEs evaluated PNR information and judged whether it can be expected to identify domestic passengers not needing additional special security measures. The SME panel recommended the weighting of information items and an algorithm/decision rule.

2.2.2 Phase 2 - Field Data Collection.

2.2.2.1 Training.

Each Northwest employee was briefed on the project's purpose and background by a representative from Northwest Security. Following this, the researchers demonstrated how to use the MDPPS instrument, discussed when to profile, and explained how and when to record elapsed time. A copy of the training brief is presented in appendix A.

2.2.2.2 Pilot Test.

Prior to operational testing, a pilot test was conducted to determine the efficiency and effectiveness of the proposed test procedures.

Two Northwest gate agents participated in the pilot test and eight passengers from one flight were profiled. Profilers had little or no difficulty following the profiling procedures (e.g., using the worksheet, profile scoring and clearance decision, and timing). One issue that arose during the pilot testing was the need to stress, in the pre-profile briefing, that all relevant databases should be accessed in an attempt to complete as much of the worksheet as possible. Additional instructions addressing this issue were incorporated in the operational test briefing. The data available to the ticket agent for real-time profiling consisted of the PNR, the Frequent Flyer database, the ticket lift and any other travel papers, and some limited access to the baggage system (it does not appear that this last form of data was used, but one ticket agent did access it). As the testing emphasized passive profiling, ticket agents were instructed not to actively question passengers for information.

2.2.2.3 Operational Test.

Five Northwest employees used the MDPPS to screen passengers in real-time, while Galaxy Scientific employees used the MDPPS and PNR printouts to screen passengers off-line. Northwest employees completed the profile worksheet by computer access of the PNR as passengers checked in at the airline ticket counter or departure gate. Since the MDPPS is a "passive" system, passengers were unaware of the profile screening and checklist. Upon completing the profile checklist, employees totaled the points and compared two scores, one for cleared and one for not-cleared. If the cleared score was higher, passengers would be free to proceed; if the not-cleared scores was higher, passengers would be given additional screening. Tied scores were considered as not-cleared throughout the testing and subsequent data analyses. Note that the passengers not clearing did not receive special treatment in the IOT&E.

2.3 CONDUCT OF TEST.

2.3.1 Operational Context.

The IOT&E was conducted at the Northwest terminal, General Mitchell International Airport, Milwaukee, Wisconsin from February 22 to 25, 1994. A sign with the following text was located at each ticket or gate counter where profiling occurred: "Northwest Airlines and the Federal Aviation Administration are conducting a research project concerning the check in procedures for this flight. We apologize for any inconvenience this may cause you, and appreciate your understanding and patience. Thank you, and enjoy your flight."

2.3.2 Test Events.

Table 2 gives the number of iterations of each test event. Detailed descriptions of each event are given in section 3.

TABLE 2. TEST EVENTS

Profiles	Passengers
Real-Time	133
Off-Line	228

2.3.3 Overall Methodology.

2.3.3.1 Phase 1 - SME Panel.

SME panel data were collected in two phases. First, worksheets were sent to panel members as part of the pre-meeting briefing package mailed to each attendee. SMEs were asked to fill these out and return them before the meeting. The data from these worksheets were compiled and used during the meeting discussions.

Second, during the SME panel meeting, data were collected as the discussions progressed. The final selection of data elements, and their associated weights, were compiled and verified with the panel members.

2.3.3.2 Phase 2 - Field Test.

The MDPPS instrument was field tested both in real-time and off-line. In real-time, airline employees profiled passengers, as part of the check in procedures for departing flights, accessing appropriate databases (e.g., PNR) and the ticket lifts. Off-line, the researchers profiled passengers using printed PNR data and ticket lifts.

2.4 TEST DATA MANAGEMENT.

2.4.1 Database Management.

Table 3 shows the database layout for the data collected. Letters refer to category information in figure 1.

2.5 TRAINING CONDUCTED.

2.5.1 Airline Employees.

Each Northwest employee participating in the testing was briefed on the project's purpose and background by a representative from Northwest Security. Following this, the researchers demonstrated how to use the MDPPS instrument and the stopwatches. A copy of the briefing materials is presented in appendix A.

TABLE 3. DATABASE LAYOUT FOR DATA COLLECTED

Variable
Case Number
Passenger Name Record Identification
Flight Number
Date
Position of Profiler
A (checked/not checked)
B (checked/not checked)
C (checked/not checked)
D (checked/not checked)
E (checked/not checked)
F (checked/not checked)
G (checked/not checked)
H (checked/not checked)
I (checked/not checked)
Time to Profile
Auto Cleared
Clearance Score
Non-Clearance Score
Clearance Decision
Basis for Decision

FIGURE 1. MDPPS INSTRUMENT

FIGURE REMOVED FROM PUBLICATION

To obtain a copy of the figure, submit a written request citing this document and a justification to:

THE ASSISTANT ADMINISTRATOR FOR CIVIL AVIATION SECURITY, ACS-1
FEDERAL AVIATION ADMINISTRATION
800 INDEPENDENCE AVENUE, SW
WASHINGTON, DC 20591

3. TEST AND EVALUATION RESULTS.

3.1 ISSUE 1 - SME WORKSHOP.

Do airlines' CRS databases contain information elements appropriate for identifying passengers judged not to be a threat on domestic flights?

3.1.1 Criterion 1.1 - Identify MDPPS Data Elements.

The SME panel will recommend particular information items to be used as factors in the MDPPS job aid.

3.1.1.1 MOP 1.

Consensual evaluation of the validity for each PNR element.

3.1.1.2 MOP 2.

Consensual evaluation of any additional information readily available to the airline profiler.

3.1.1.2.1 Specific Methodology.

a. Pre-workshop packages were mailed to each SME that included worksheets that provided the type of information collected by the currently used PNR. SMEs reviewed the worksheets to determine which elements were appropriate for passenger profiling, and rated the element's criticality in clearing a passenger. Criticality was determined using a 5-point scale as presented on the worksheet. The worksheets were completed individually in advance and then discussed at the group meeting to reach a consensus.

b. SMEs completed an additional worksheet to identify further data elements not included in the PNR.

3.1.1.2.2 Data.

Figure 1 presents the SME recommended data elements.

3.1.1.2.3 Analysis and Discussion.

SMEs reviewed a list of objective data elements currently available to airline personnel to determine those essential in passenger profiling. The data elements provided information about a passenger and were potentially useful in identifying non-threat individuals. All data elements were taken from currently implemented CRS (e.g., Northwest PNR, ticket lifts) and provided to SMEs in pre-workshop worksheets. The SMEs were also asked to recommend additional data elements, to include in the MDPPS, which are currently available to the airlines.

3.1.1.2.4 Criterion Findings and Discussion.

The SME panel was able to consensually evaluate available data elements. These data elements were determined to be useful as potential indicators for passenger profiling to eliminate passengers not needing special screening.

3.1.2 Criterion 1.2 - Determine Weighting Mechanism.

The SME panel will recommend the weighting of information items to be used as factors in the MDPPS job aid.

3.1.2.1 MOP 3.

Consensual evaluation of weighting factors for information elements.

3.1.2.1.1 Specific Methodology.

The weighting mechanism and the decision tool were developed in tandem. Once the data elements were agreed upon, the SMEs assigned positive and negative weights to each of the elements.

3.1.2.1.2 Data.

Figure 1 presents the recommended weightings.

3.1.2.1.3 Analysis and Discussion.

Each piece of information collected about a potential passenger did not have the same degree of importance in determining a profile status. Upon selection of the essential data elements, SMEs assigned weights independently and then met as a group to reach a consensus.

3.1.2.1.4 Criterion 1.2 Findings and Discussion.

The SME panel was able to apply weightings to the information items. This weighting system employed positive and negative point values as well as an automatic clearance weighting assigned to certain data elements.

3.1.3 Criterion 1.3 - Recommend Algorithm/Decision Rule.

The SME panel will recommend an algorithm/decision rule for using the information items, plus any necessary factor weightings for using the decision rule.

3.1.3.1 MOP 4.

Consensual evaluation of the decision rule for combining information elements.

3.1.3.1.1 Specific Methodology.

a. Once the data elements and weightings were assigned, the SMEs categorized each element into one of nine categories.

b. To obtain a passenger's status, the MDPFS worksheet required profilers to sum the element weights across categories and obtain a cleared total and a not-cleared total. A passenger's status was determined by the highest weighted total. Thus, if the cleared weighted total was greater than the absolute value of the not-cleared weighted total, a passenger would clear and not require further special screening. Alternatively, if a passenger's profile obtained a higher absolute value of not-cleared total, the passenger would require further special screening. Tied scores were considered as not-cleared and the passenger would require further special screening.

3.1.3.1.2 Data.

Figure 1 presents the positive and negative weights for each element that would be totaled to reach a cleared or not-cleared decision.

3.1.3.1.3 Analysis and Discussion.

Most factors were assigned a positive or negative weight ranging from -5 to +5. Critical factors deemed to have major decision making implications were assigned as either "Auto-Cleared," or given a high positive (+20) or a high negative (-30) weight. Upon completing the profile worksheet, airline employees sum down the positive and negative columns to obtain two weighted totals. The higher total indicates a "cleared" or "not-cleared" status to a passenger. Thus, the higher absolute score determines the passenger's profile status.

3.1.3.2 MOP 5.

Job aid worksheet for profilers.

3.1.3.1.1 Specific Methodology.

The MDPPS worksheet was based on the SME panel recommendations for data elements, relative weightings, and the decision rule. This worksheet was used to perform the manual profiling tested for Issues 2 and 3. The job aid worksheet format was designed by the Galaxy Scientific test team and accepted by the FAA monitors and Northwest corporate security personnel.

3.1.3.1.2 Data.

Figure 1 presents the tested passive profile worksheet.

3.1.3.1.2 Analysis and Discussion.

The developed profile worksheet provides a synthesis of the SME panel recommendations field tested in Milwaukee, Wisconsin.

3.1.3.1.4 Criterion 1.3 Findings and Discussion.

The SME panel was able to develop a decision rule for the combination of weighted data elements into a passenger profiling score. These data elements were then combined into a profile worksheet reviewed and accepted by FAA and Northwest personnel.

3.2 ISSUE 2 - DECISION DATA.

Does the profiling system eliminate most domestic passengers from requiring special security treatment?

3.2.1 Criterion 2.1.

None. This issue is investigative in nature.

3.2.1.1 MOP 6.

Number of domestic passengers profiled on various types of flights.

3.2.1.1.1 Specific Methodology.

a. Passenger profiling was conducted February 22-24, 1994 in Milwaukee, Wisconsin.

b. Five Northwest employees profiled passengers in real-time and Galaxy employees profiled passengers under off-line conditions. The real-time profiling required Northwest employees to complete the MDPPS worksheet as passengers checked in at the airline ticket counter or departure gate. Employees completed the profile worksheet by accessing the PNR, Frequent Flyer, and ticket lift data. Since MDPPS is a "passive" system, passengers were unaware of the profile screening and checklist.

c. The off-line screening required Galaxy employees to examine printed PNR passenger data and complete the MDPPS without the passenger present. The off-line screenings occurred in Northwest airport offices.

d. The number of passengers profiled in both real-time and off-line conditions was determined.

3.2.1.1.2A Data - Real Time.

Passengers on 21 Northwest flights were profiled. The flight number, number of passengers profiled, and the percentage of the total passengers profiled is presented in table 4.

A total of 133 passengers were profiled in real-time. The flight numbers of five passengers were not recorded, although those five passengers were profiled.

TABLE 4. PASSENGERS PROFILED

Northwest Airlines Flight Number	Number Profiled
185	4
230	6
299	1
377	20
405	3
422	7
424	4
428	4
430	5
449	1
493	1
499	14
552	1
553	6
577	1
583	1
653	13
659	3
853	1
953	10
1617	22
(unknown)	5

3.2.1.1.2B Data - Off-Line.

There were 228 passengers profiled off-line. The distribution of these passengers is provided in table 5.

TABLE 5. FLIGHT NUMBERS AND NUMBER OF PASSENGERS PROFILED

Flight Number	Number of Passengers Profiled
377	65
430	107
653	56

3.2.1.1.3 Analysis and Discussion.

a. The wide disparity in the number of passengers profiled per flight in table 4 can potentially be accounted for by the liberal check in policies of Northwest. At the Milwaukee airport, for example Northwest passengers are permitted to check in at any Northwest ticket counter or gate. Therefore,

agents, especially gate agents, frequently check in some of the passengers leaving on a flight that departs from an adjacent gate.

b. Passengers were profiled faster with the off-line setting. Thus, table 5 shows more passengers were profiled, from fewer flights, than with the real-time condition. However, this off-line capability was found to have limited utility. Note that for each flight listed in table 5, the number of passengers profiled represents the total number of passengers on the flight (i.e., a complete flight was profiled).

3.2.1.2 MOP 7A - Cleared Versus Not-Cleared.

Number of domestic passengers cleared by MDPPS.

3.2.1.2.1 Specific Methodology.

a. Manual on-line profiling was conducted on a random selection of passengers from numerous Northwest flights. Employees used the MDPPS worksheet to profile when it did not interfere with their job.

b. Manual off-line profiling was conducted for all passengers on three Northwest flights, as presented in table 5.

c. Upon completing the MDPPS worksheet, employees totaled the points. If the cleared scores were higher, passengers were cleared to proceed; if the not-cleared scores were higher, passengers were required to receive additional screening.

3.2.1.2.2A Data - Real-Time.

Figure 2 shows the percentage of passengers cleared and not-cleared in real-time condition. From a total of 133 profiled passengers, 85.0 percent (113 passengers) were cleared, while 15.0 percent (20 passengers) were not-cleared.

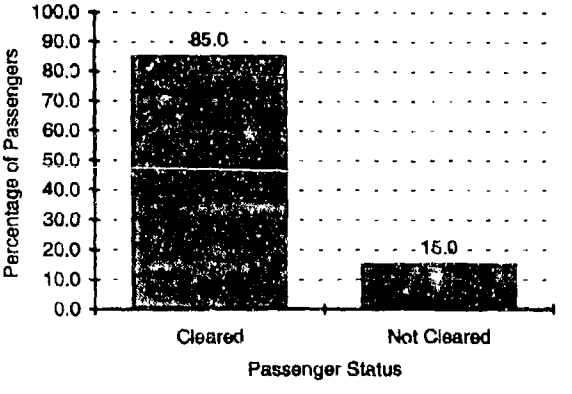


FIGURE 2. PERCENTAGE OF PASSENGERS CLEARED AND NOT-CLEARED IN REAL-TIME

3.2.1.2.2B Data - Off-Line.

a. Figure 3 shows the percentage of passengers cleared and not-cleared in off-line condition. From a total of 228 passengers, 49.6 percent (113 passengers) were cleared and 50.4 percent (115 passengers) were not-cleared.

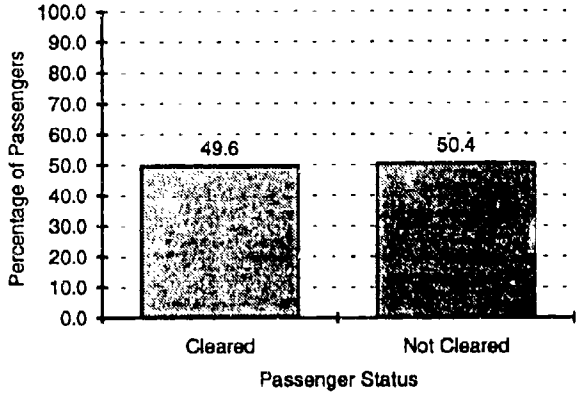


FIGURE 3. PERCENTAGE OF PASSENGERS CLEARED AND NOT-CLEARED OFF-LINE

b. Figure 4 compares the percentage of cleared and not-cleared passengers when the employees used only the PNR data (PNR Only), versus using both PNR and ticket lift data (PNR & Ticket Lift). These percentages are based on samples of 107 "PNR Only" passengers (31 cleared) and 121 "PNR & Ticket Lift" passengers (82 cleared).

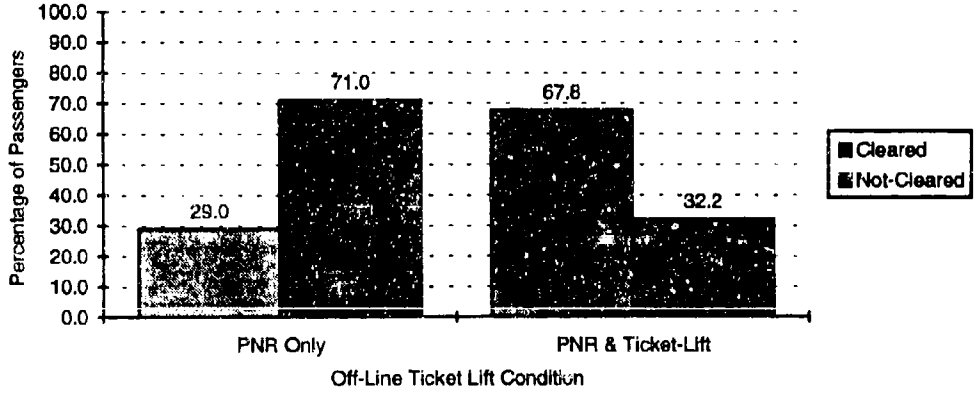


FIGURE 4. THE PERCENTAGE OF CLEARED AND NOT-CLEARED PASSENGERS WHEN THE PROFILERS USED ONLY THE PNR DATA (PNR ONLY), VERSUS BOTH PNR AND TICKET LIFT DATA (PNR & TICKET LIFT).

3.2.1.2.3 Analysis and Discussion.

a. Figure 2 shows the number of passengers that employees cleared and not-cleared in the real-time condition. From a total of 133 profiled passengers, 85.0 percent (113 passengers) were cleared, while 15.0 percent (20 passengers) were not-cleared. Cleared score values ranged from 0 to 29, with a mean of 8.35. The range of the not-cleared scores was from -13 to 0, with a mean score of -2.09.

b. Figure 3 shows the percentage of passengers cleared was about the same as not-cleared in the off-line condition. From a total of 228 passengers, 49.6 percent were cleared and 50.4 percent were not-cleared.

c. Figure 4 shows the percentage of cleared passengers was much greater when both PNR and ticket lift data were used. When both PNR and ticket lift data were used, 67.8 percent were cleared (82 passengers out of the total 121 "PNR & Ticket-Lift" passengers). In comparison, 29.0 percent cleared when using only the PNR data (31 passengers out of the total 107 "PNR Only" passengers). Thus, the use of both sets of information provided more information needed to clear passengers.

d. The proportion of clear versus not-clear decisions was substantially different in the off-line condition as compared to the real-time condition. For real-time profiling, it appeared that more complete PNR data may have been available due to more information coming across in the last few hours before the flight. For example, the booking date did not appear in many of the off-line PNRs and this lack of information could affect the overall clearance rate. This discussion is amplified in section 3.2.1.3, and a supporting analysis is presented in Appendix B.

3.2.1.2 MOP 7B - Auto-Cleared Versus Not Auto-Cleared.

Number of domestic passengers auto-cleared by MDPPS.

3.2.1.2.1 Specific Methodology.

a. Some MDPPS worksheet factors allowed automatic clearance. Referred as auto-clear, this status allowed particular passengers to bypass additional profiling (See figure 1, category A).

b. Assigning a passenger auto-clear status automatically clears a passenger and completes the MDPPS worksheet.

3.2.1.2.2A Data - Real Time.

Figure 5 shows the percentage of passengers auto-cleared and not-auto-cleared. From 133 passengers profiled real-time, 12.8 percent (17 passengers) had an auto-clear status, where 87.2 percent (116 passengers) did not have an auto-clear status.

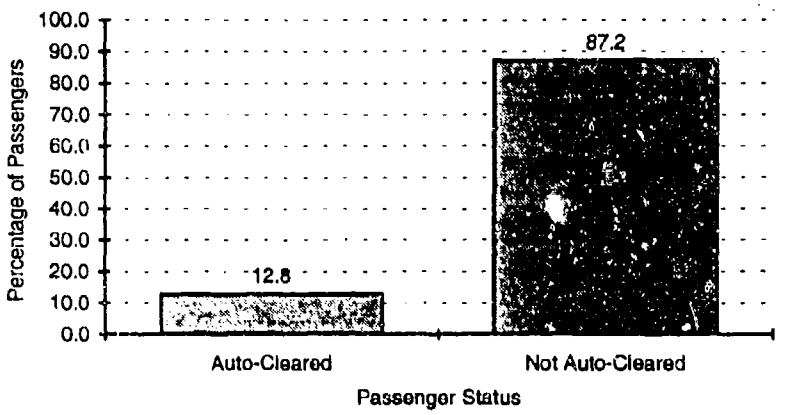


FIGURE 5. PERCENTAGE OF PASSENGERS AUTO-CLEARED IN REAL-TIME VERSUS THOSE NOT AUTO-CLEARED (INCLUDES THOSE PASSENGERS WHO DID NOT CLEAR ON MERIT)

3.2.1.2.2B Data - Off-Line.

Figure 6 shows the percentage of passengers auto-cleared and not-auto-cleared off-line. From the 228 off-line passengers profiled, 10.5 percent (24 passengers, 20.9 percent of the cleared passengers) were auto-cleared, while 89.5 percent (204 passengers) were not-auto-cleared.

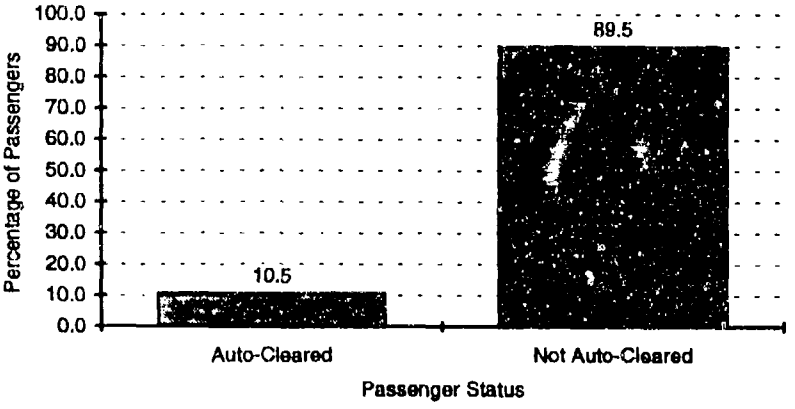


FIGURE 6. PERCENTAGE OF PASSENGERS AUTO-CLEARED OFF-LINE VERSUS THOSE NOT AUTO-CLEARED (INCLUDES THOSE PASSENGERS WHO DID NOT CLEAR ON MERIT)

3.2.1.2.3 Analysis and Discussion.

a. Figure 5 shows the percentage of passengers who were auto-cleared and not-auto-cleared in real-time. Passengers who received an auto-cleared status include only those who met the appropriate "cleared" rating, while not-auto-cleared passengers include all passengers who were later cleared on merit as well as passengers who were not-cleared. From 133 passengers, 12.8 percent (17 passengers)

had an auto-clear status, where 87.2 percent (116 passengers) did not have an auto-clear status. From the total 110 subjects who were cleared (figure 2), only 15.5 percent were auto-cleared.

b. Figure 6 shows the percentage of passengers who were auto-cleared and not-auto-cleared in off-line determinations. From the 228 off-line passengers profiled, 10.5 percent (24 passengers, 20.9 percent of the cleared passengers) were auto-cleared, while 89.5 percent (204 passengers) were not-auto-cleared.

3.2.1.3 Information Category Data.

Percents of recorded information for each category using real-time and off-line data. (See figure 1.)

3.2.1.3.1 Specific Methodology.

Determine percentages of each category's data available for passengers.

3.2.1.3.2A Data - Real-Time.

Table 6 shows the percentage of passengers with information checked or recorded for each category. Results were included in this analysis if the person completing the profile had either made an entry in the category or had provided a secondary mark to indicate that relevant information had been consulted but a data entry was not applicable.

TABLE 6. PERCENTAGE OF PASSENGERS HAVING EACH CATEGORY OF INFORMATION CHECKED OR RECORDED (REAL-TIME)

Category	Percentage
A	13.5%
B	88.0%
C	86.5%
D	8.3%
E	10.5%
F	3.0%
G	44.4%
H	68.4%
I	87.2%

3.2.1.3.2B Data - Off-Line.

Table 7 shows the percentage of passengers for whom information was checked or recorded for each category. Results were included in this analysis if the person completing the profile had either made an entry in the category or had provided a secondary mark to indicate that relevant information had been consulted but a data entry was not applicable.

TABLE 7. PERCENTAGE OF PASSENGERS HAVING EACH CATEGORY OF INFORMATION CHECKED OR RECORDED (OFF-LINE)

Category	Percentage
A	8.3%
B	47.4%
C	92.5%
D	1.3%
E	2.2%
F	0.0%
G	3.1%
H	49.6%
I	90.4%

3.2.1.3.3 Analysis and Discussion.

a. Table 6 shows that the real-time percentages of available category information ranges from 3.0 percent (F) to 88.0 percent (B). The categories B, I, and C obtained the highest availability percentages, 88.0, 87.2, and 86.5 percents. Profiles for passengers with information in all categories were obtained in less than 25 percent of the cases.

b. Table 7 shows that the off-line percentages of available category information ranges from 0.0 percent (F) to 92.5.0 percent (C). The categories C and I obtained the highest percentages, 92.5 percent and 90.4 percent.

c. The results of this analysis differ from those in the real-time condition, particularly in regards to category B. Note that for real-time profiling, two factors may have influenced the clearance rate: 1) "richer" PNR data may have been available due to more electronic information coming across in the last few hours before the flight or 2) the ticket agents were using the ticket issue date off of the ticket lift instead of the booking date. The latter procedure is only safe if the ticket issue date is substantially before the flight day. If only the ticket issue date was used, a greater proportion of people would "not-clear" as they would accrue less positive points due to lags in ticket issue versus booking dates

3.2.1.4 MOP 7C - Category Decision Analysis - Real-Time.

Determine the minimal critical categories of the MDPPS worksheet needed to identify cleared passengers.

3.2.1.4.1 Specific Methodology.

a. Cleared and not-cleared scores were recalculated by eliminating individual categories. Eliminating categories identifies the most critical information on the MDPPS worksheet to clear passengers by assessing the impact of unavailable information. The scores were recalculated by summing the points of the remaining categories. The number of cleared and not-cleared passengers was then reevaluated to identify those categories that had little effect on the outcome of a passenger's status.

For example, a certain data category might be difficult to obtain in that it requires access to an extra portion of the computer system and this access may impose a large time penalty. However, the additional information that this data point may contribute to the overall clearance score might be minimal. Therefore, the elimination of the category might be considered as it might not have a large negative affect on the clearance rate. Essentially, this analysis helps to define a cost-benefit relationship for the categories identified by the SME panel. The one caveat to this analysis is that certain categories of data are essential to the profile and are critical security items, and therefore must be obtained despite any associated time or monetary costs.

b. In addition, the number of cleared and not-cleared passengers was recalculated with information that would only be available from ticket lifts. The assumption behind this analysis is that a backup method (using ticket lift data only) of performing profiling should be identified if the computer systems fail, or for those air carriers that do not have computerized reservation system access. This analysis provides a percentage of the cleared and not-cleared passengers using only the ticket lift categories when the PNR data is not available.

The rationale for this analysis is similar to the essential category analysis in that it seeks to reduce the candidate data items and identify a workable subset. However, unlike the essential category analysis, this analysis is driven by the data content of the ticket lift, and not by the security value of the information.

3.2.1.4.2 Data - Real Time.

a. Table 8 shows the adjusted percentages of passengers not-cleared when information was not available for an entire category (individual categories were eliminated). Thus, the passenger status scores were recalculated upon eliminating each category. The percentages of passengers not-cleared using all categories (prior to any score adjustments) is indicated as (All).

TABLE 8. PASSENGER STATUS WITH INDIVIDUAL CATEGORIES ELIMINATED

Category	Percent Not-Cleared
I	27.1%
A	26.3%
B	24.8%
H	23.3%
C	21.8%
G	17.3%
E	16.5%
D	16.5%
F	15.8%
(All)	15.0%

b. Figure 7 shows the percentage of passengers cleared assuming that the four categories with the least individual effect (D, E, F, G) are not included in the profile. For this analysis, the scores were adjusted by using only categories A, B, C, H, and I.

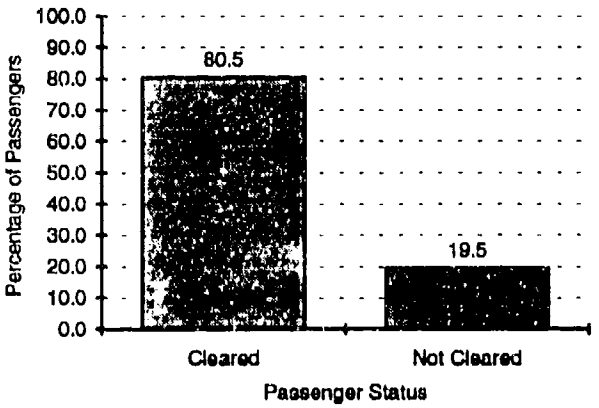


FIGURE 7. PASSENGER STATUS BASED ON FIVE ESSENTIAL CATEGORIES (A, B, C, H, I)

c. Figure 8 shows that the percentage of passengers cleared and not-cleared when performing profiling using information available when only using the ticket lift (i.e., the PNR data is not available due to system failure, etc.). For this analysis, categories A, E, F, G, H are eliminated from the profile.

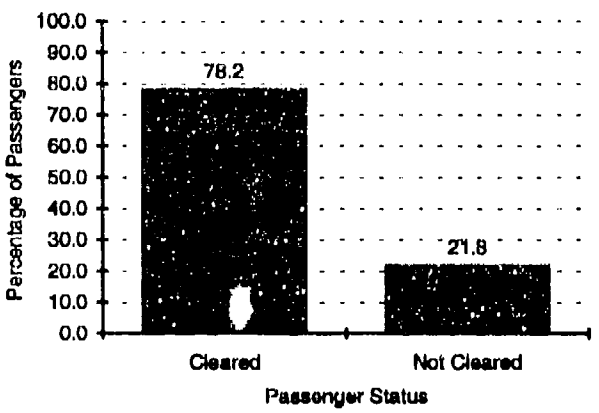


FIGURE 8. PASSENGER STATUS BASED SOLELY ON TICKET LIFT INFORMATION (CATEGORIES B, C, D, I)

3.2.1.4.3 Analysis and Discussion.

a. Table 8 shows that the percentage of not-cleared passengers decreased for every category, after eliminating each category. The analysis for category G was adjusted for redundant data elements with category A. The range of the recalculated cleared scores was from 84.2 percent to 72.9 percent, while the range of the recalculated not-cleared scores was from 27.1 percent to 15.8 percent.

b. Figure 7 also shows a minimal percentage difference in passenger status (compared to the original cleared and not-cleared passengers) with four categories (D, E, F, and G) omitted. Only 4.5

percent fewer passengers were not-cleared without the D, E, F, and G categories. This suggests that these categories may not provide information that strongly influences the outcome to clear or not-clear a passenger, hence needlessly increasing the time to complete the worksheet. Note that the group of passengers who were originally not cleared using the full profile remain in the group of not cleared passengers after using the subset of profile elements in the essential category analysis. In other words, no passengers migrated from not-cleared to cleared due to the elimination of categories. It is suggested that the SMEs reconsider the currently used categories for the elimination of those categories that may not provide needed information.

c. Figure 8 shows that the percentage of passengers cleared was 78.2 percent when performing profiling using only the ticket lift. Data categories from the PNR, A, E, F, G, and H, were dropped from the profile. Again, no passengers migrated from not-cleared to cleared due to the elimination of categories. However, this solution is not acceptable in terms of the security requirements for passenger profiling. Some of the categories dropped in the ticket lift analysis contain security information that is critical to the profile's accuracy and thus inhibit the use of this analysis.

3.2.2 Criterion 2.1 Findings and Discussion.

The findings for this criterion indicate that the profiling system eliminates many domestic passengers from requiring additional special security treatment. Approximately 85 percent of passengers were eliminated in the real time data collection.

The analysis of critical data items indicates that several of the data categories had little impact on the overall clearance rate. This finding indicates that these data categories could be dropped from subsequent profiling data collections with minimal (4.5 percent) reduction in percentage cleared.

The ticket lift analysis, although not substantially changing the resulting clearance rate, might be unacceptable due to a possible security risk associated with the elimination of some of the data categories, notably category A.

3.3 ISSUE 3 - RESOURCE REQUIREMENTS.

Does the domestic passenger profiling system require excessive resource requirements?

3.3.1 Criterion 3.1.

None. This issue is investigative in nature.

3.3.1.1 MOP 8A - Resource Analysis - Real-Time.

Profile resource requirements for CRS data.

3.3.1.1.1 Specific Methodology.

a. A distribution of profile completion times indicates how long it would take to profile each passenger.

b. An ANalysis Of VAriance (ANOVA) was completed to determine a significant difference between time to profile not-clear and clear status passengers.

3.3.1.1.2 Data.

Figure 9 shows the distribution of times to complete the screening process in real time. Figure 10 shows the average time required to reach a profile decision.

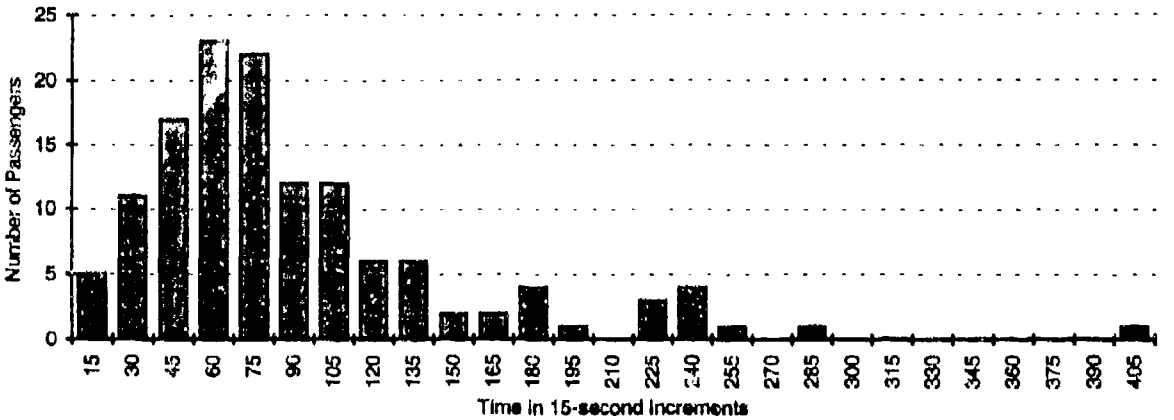


FIGURE 9. DISTRIBUTION OF TIMES TO PROFILE IN 15 SECOND INCREMENTS

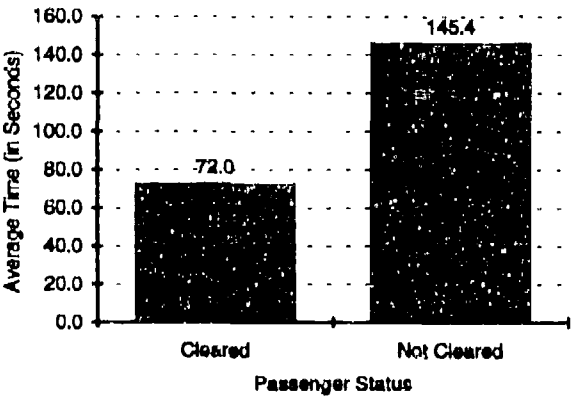


FIGURE 10. AVERAGE TIME TO REACH PROFILING DECISION (REAL-TIME)

3.3.1.1.3 Analysis and Discussion.

a. Figure 9 shows the breakdown of time to profile in 15 second increments. The mean time to complete a passenger profile was 83 seconds.

b. An ANOVA revealed that there was a significant time difference among the profile conditions (i.e., cleared or not-cleared). As shown in figure 11, the mean time to profile passengers who were not-cleared (145.4 seconds, standard deviation (SD) = 100.0 seconds) was significantly higher than the mean time to profile cleared passengers (72.0 seconds, SD = 46.2 seconds), $F(1, 131) = 27.84$, $p \leq .001$.

In examining the time distribution in Figure 9, it is apparent that there is some effect on the time due to outlying data points. Therefore, an analysis was conducted to determine the predicted upper time extremes (i.e., what is the maximum times that can be expected). By applying normal curve statistics, the time per passenger to screen 95 percent of the passenger sample was calculated (This calculation is as follows: $95\%Time = Mean + (1.96)(SD)$). The resulting calculation indicates that it would take approximately 5 minutes 41 seconds to profile not-cleared passengers at the 95 percent upper time bound, and approximately 2 minutes 43 seconds for cleared passengers at the 95 percent upper time bound. In a larger application, there could be passengers whose profiling time exceeds the 95 percent boundary, but the incidence of these passengers is small.

3.3.1.2 MOP 8B - Ticket Lift Decision Analysis - Off-Line.

Compare the time to reach a clearance decision in off-line settings using PNR and ticket lift information.

3.3.1.2.1 Specific Methodology.

a. The times required to clear a passenger were determined when employees used the PNR data, and both the PNR and ticket lift data.

b. The cleared and not-cleared points were totaled to determine the amount of time employees required to use the MDPPS worksheet with PNR and ticket lift information.

3.3.1.2.2 Data.

Figure 11 shows the average times to reach a clearance decision using only PNR, or both PNR and ticket lift information.

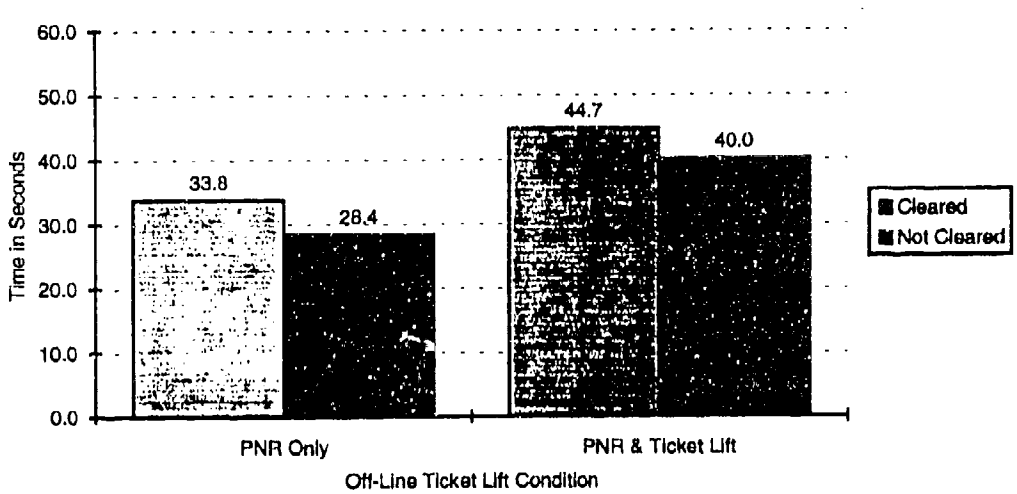


FIGURE 11. THE MEAN TIME TO CLEAR A PASSENGER IN OFF-LINE USING ONLY PNR, OR BOTH PNR AND TICKET LIFT INFORMATION

3.3.1.2.3 Analysis and Discussion.

a. Figure 11 presents the average time to clear a passenger when employees used only the PNR data (33.8 seconds, SD = 12.2 seconds), and the time to clear when using the PNR and ticket lift information (44.7 seconds, SD = 24.0 seconds).

Using the same normal curve statistical assumptions as applied to the real-time data, it would take approximately 58 seconds to profile the passenger at the 95 percent upper time using only PNR data and approximately 92 seconds to profile the passenger at the 95 percent upper time using both the PNR and ticket lift data.

An ANOVA was conducted to determine if the times to clear passengers with or without the ticket lift Information were significantly different. The ANOVA indicates that it took significantly longer to clear a passenger when using both the PNR and ticket lift data, $F(1, 221) = 21.64$, $p < .001$.

b. An ANOVA was also conducted to determine if it took longer to clear or not clear passengers regardless of the information the employees accessed. It took longer to clear passengers (39.3 seconds) than to not-clear passengers (34.2 seconds), $F(1, 221) = 4.40$, $p = .04$. NOTE: There were seven cases of missing time data.

c. Note that it took longer to profile "cleared" passengers than "not cleared" passengers in the off-line condition. This finding is opposite that of the real-time condition. It is probable that this is due to the familiarity of the worksheet that was gained and the interaction with limited data available in the off-line condition. For example, it became obvious that a passenger's negative values exceeded the limit quickly, and with limited additional information to search for, a not-clear decision could be reached quickly.

3.3.1.3 MOP 8C - Resource Requirements.

Using the collected real-time timing data, determine the resource requirements to perform manual profiling.

3.3.1.3.1 Specific Methodology.

a. The times required to clear a passenger were forwarded to Northwest Airlines for analysis.

b. Specific items requested included direct costs, indirect costs, assumptions for the cost analyses, and facility alterations.

3.3.1.3.2 Data.

Supplied by Northwest Airlines.

3.3.1.3.2.1 Resources Relating to Airline Personnel.

a. 150 new Customer Service Agents.

b. $8,343,900/yr salary and benefits for 150 new Customer Service Agents.

c. $685,800/yr. salary and benefits during 30 days of training for new employees.

d. An estimated 60-90 days in addition to the training period to recruit, train, hire, and perform FAA required background and drug testing.

3.3.1.3.2.2 Resources Relating to Non-Airline Personnel.

a. 150 new security screeners.

b. $3,240,00/yr. for an estimated 150 security screeners.

3.3.1.3.2.3 Resources Relating to Indirect Factors.

a. $1,978,275 initial investment for equipment.

b. A 60-90 day period to obtain and install new equipment.

c. Undetermined cost and time factors for facility modifications.

3.3.1.3.3 Analysis and Discussion.

Northwest, in their response to a request for resource requirements, indicated that the above listed resource requirements would make it impossible to keep MDPPS within the guidelines for good Crisis Management. However, it should be noted that the additional cost to profile on a per passenger basis is

modest. Including equipment costs in the first year, personnel and equipment costs estimated at $14,247,975 represent $0.39 per passenger for the 1993 enplanements of 36,510,878 passengers. The second and third years per passenger additional costs would be $0.34 per passenger.

Appendix B contains the full response of Northwest Airlines.

3.3.2 Criterion 3.1 Findings and Discussion.

The findings for this criterion indicate the resource requirements and considerable for manual profiling, both in real-time and off-line applications. The times recorded for both data collection techniques indicate that inclusion of the manual instrument into the normal ticket operations would impact overall airline operations. The cost figures provided by Northwest indicate that the resources required to support these times are high but achievable on a per person basis.

The exact determination as to whether these costs are excessive to the industry is not for this IOT&E to judge. However, the data does indicate that a substantial investment in time, training, facilities and resources would be required prior to the onset of a threat level situation. It is highly improbable that the required actions and personnel could be quickly put in place in response to a threat without requiring extensive preparation from the airlines.

3.4 SUMMARY OF INTERVIEW DATA.

a. Profiler comments can be grouped into three main areas of concern. First, the "perceived" time to profile passengers. Passenger check in is often rushed and passengers are typically nervous, annoyed or impatient. Initially, the profilers felt that the additional task of profiling would greatly increase the time it took to check in passengers, and thus increase tensions in passengers. During the debriefing, however, profilers indicated that the time commitment was not as severe as originally feared. If the system were imposed on the ticket agents during a heavily traveled time period, however, this opinion might remain negative.

b. Second, profilers felt some of the categories in the profiling instrument were unnecessary. Information, such as D and F, had little mathematical value and, in their opinion, implied less about known individuals than other categories.

c. Finally, profilers found that information in some categories was not easily accessible. For example, G (other than advanced membership) must be obtained from a separate database than that containing the PNR. Switching to this database is cumbersome and time consuming.

4. OVERALL CONCLUSIONS AND RECOMMENDATIONS.

4.1 OPERATIONAL EFFECTIVENESS CONCLUSIONS.

IOT&E of the MDPPS showed that it was possible, using data elements currently available to airline employees, to eliminate most passengers from requiring special security treatment.

Results from Phase 1 of the IOT&E, and the SME panel, indicate it was possible to consensually validate available data elements. The SMEs identified data elements that were useful indicators for passenger profiling, and applied weightings to the information items. This weighting system used point values, as well as automatic clearing. The SME panel was also able to develop a decision rule for the combination of weighted data elements into a passenger profiling score. These data elements were then combined into a profile worksheet.

Results from Phase 2 of the IOT&E, the operational field data collection, indicate that the profiling system as defined does eliminate most domestic passengers from requiring special security treatment. Approximately 85 percent of passengers were eliminated in the real-time data collection. The analysis of critical data items indicates that several of the data categories had little impact on the overall clearance rate. This finding indicates that these data categories may be dropped from subsequent profiling data collections with minimal negative effect.

In addition, a respectable percentage can be cleared by using only ticket lift data. However, due to the elimination of some critical data categories not available on the ticket lift, the ticket lift only form of passive profiling is not recommended

4.2 OPERATIONAL SUITABILITY CONCLUSIONS.

IOT&E findings on the resource requirements for the MDPPS indicate considerable requirements. The times recorded for both applications show that inclusion of the manual instrument into the normal ticket operations would impact overall airline operations significantly. The cost figures provided by Northwest indicate that the resources required to support these times are accordingly high.

The data indicates that a substantial investment in time, training, facilities and resources would be required *prior* to the onset of a threat level situation. It is highly improbable that the required actions and personnel could be put in place in a short duration without requiring extensive preparation from the airlines.

4.3 RECOMMENDATIONS.

4.3.1 System Design Improvements.

a. Data Sharing Between Airlines. Informational element availability suggests that the lack of relevant information contained in the PNRs may have had a negative impact on the overall clearance rate. Although it is impossible to determine if data in certain categories was incomplete due to a lack of information or actually due to not complying with the category's requirements, it is reasonable to assume that the overall clearance rate would have increased if complete PNRs were available through data

sharing between computer reservation systems, currently this is not the case. When one airline "hands over" a passenger to another airline, only minimal information is transferred. This situation makes it difficult to profile passengers due to a severe lack of information and would need to be addressed as an implementation issue.

b. Mandatory Data Fields. The overall clearance level may be increased by requiring that information on certain critical data elements be available for every passenger. Current CRS's permit travel and airline reservation employees to skip, override, and delete certain fields. This may lead to a lack of critical profiling information and make it difficult, if not impossible, to pass an otherwise "known" individual.

c. Automated Profiling System. Passenger profiling can be conducted most efficiently and effectively using an automated system. An automated system can access multiple databases, calculate a profiling score, and provide the airline ticket or gate agent with a clearance score quickly and more accurately than a manual system. An automated system, once developed and implemented, would be more cost-effective in that it requires less personnel training and would not delay passengers at check in.

d. Ticket Lift Profiling. Most passengers can be cleared based on information contained on their ticket. A template would expedite the profiling process. This procedure has value as a potential backup system to automated profiling and as a primary system for airlines not able to automate. However, this approach must be used with caution as some essential security categories would not be accessible using the ticket lift alone.

4.4 IMPLEMENTATION ISSUES.

The IOT&E did not collect data on implementation issues and concerns; however, several concerns did arise during the testing and are briefly mentioned.

a. Not-Cleared Passengers. With the MDPPS, a majority of the passengers cleared; however, some did not. Upon implementation of a profiling system, either manual or automated, provisions must be made for those individuals identified as requiring additional special security treatment. For example, policy and procedure statements for airlines in dealing with these passengers must be drafted, and a physical space appropriate for additional security measures must be made available. Additional security personnel and equipment may need to be available to conduct additional screening.

b. Airline Operational Changes. With the implementation of a profiling system, it will be necessary to modify current airline operations for passenger flow, including check in and boarding. Certain procedures, such as curb side baggage check and travel agent issued boarding passes may have to be eliminated. Other potential examples of operational changes include limiting access to departure gates and funneling passengers and bags through special screening.

APPENDIX A

MDPPS Instructions for the Real Time Test

Manual Domestic Passenger Profiling System (MDPPS)
Instructions for the Real Time Test

Thank you for participating in the real time test of the Manual Domestic Passenger Profiling System. As you probably already know, this program is a joint research project between the FAA and Northwest Airlines, specifically the Security Office in Minneapolis.

Why your participation is critical.

The main focus of the program is to assess the usefulness of a tool to assist in the profiling of passengers for security reasons. By collecting field data on the time required and other issues connected to using the profiling system, both the FAA and the airlines can formulate better policies about security measures should a heightened security need arise.

There are several issues connected with profiling. First, the focus of the program is to identify those passengers who are "known" quantities to the airline. If we know that a given group of people are a family heading to Orlando for a vacation, or that a certain passenger is a businessman who travels Northwest every week of the year, the assumption is that these people are not security threats. By clearing a quick-look profile, these people could board a flight without the need of further security steps.

Passengers not clearing the profile are not necessarily security threats. They are simply people on whom we don't have enough information to specifically state that they are of no risk. Subsequent security steps are still undefined, but they could be as simple as having their bags x-rayed on the way to the aircraft or to have a question or two asked of them.

At the current time, the threat to a domestic aircraft is fairly low. However, with the onset of a serious threat situation, either due to a domestic group or an international situation, the security precautions that the airline must take would increase. It is hoped that some form of profiling would reduce the impact on the traveling public and airline operations so that relatively few passengers would need time and resource consuming security interventions.

As you can see, the operational issues involved with imposing these precautions is immense. This week's data collection is the first attempt at looking at the use of profiles in the domestic market. Profiling in international travel has existed for some time, however, the parameters and dynamics of the domestic market call for a different approach than the established international system. It is hoped that a passive system, using data available from the airline's own computer data bases, could help to identify "known" passengers and lessen the impact on airline operations.

What we're asking you to do.

There are two main questions we are trying to answer with this test:

1. Can a MDPPS be administered in the field using the information available to ticket agents?
2. How much time does the MDPPS take to complete, and will this time be too much of a burden on passengers and the airline?

In turn, there are two things we are going to ask you to do:

1. Using the worksheets provided, profile every 10th passenger using the computer systems you have access to and will be instructed in over the next day.
2. Record the time it took you to profile the passenger.

How we're going to do the profiling.

We will instruct you as to how to complete the profiling sheets and how to record the times for you to profile. The next few sheets give you a blank profiling form, and a couple of completed forms. These are samples for you to use as we train you, and to refer back to if (and when) things get confusing at your position. In addition, a timeline is provided to outline how we're recording times. It is critical that we all record the times the same according to some set milestones. That way a consistent picture of the time requirements can be generated.

Who you are going to see around.

As stated earlier, this program is a joint research project between the FAA and Northwest Airlines. There are several people in Milwaukee from Northwest Security, who are sponsoring the study. In addition, there are several people from the FAA's Aviation Security group and their contractor, Galaxy Scientific Corporation. All of these people are involved in running the study, and any of them can help you if there are any problems at any time.

In addition, there may be other people observing what is happening during the day on Wednesday. These people represent the unions, the airport authority, Northwest management, and other airlines. Be assured that nothing you do will be examined in any terms other than the profiling system. The people in attendance are not interested in critiquing your work at the counter, but whether you can use the tools they are designing.

A few notes for concerns you may have.

This is a research project. We are not checking for the accuracy of your completion, and other than the position that you are working, we are not recording who specifically completes the worksheet. While accuracy is important to us, we are not going to report the findings as linked to any person in particular. In addition, we are not linking the findings to any specific passenger.

The profiling is going to take some time to perform. We do not want to unnecessarily delay or inconvenience any passenger. Signs will be posted informing them of a study occurring, but if in your judgment a passenger is being inconvenienced, stop the profiling and service the customer. We will record lots of data, and losing a few worksheets will not harm the test.

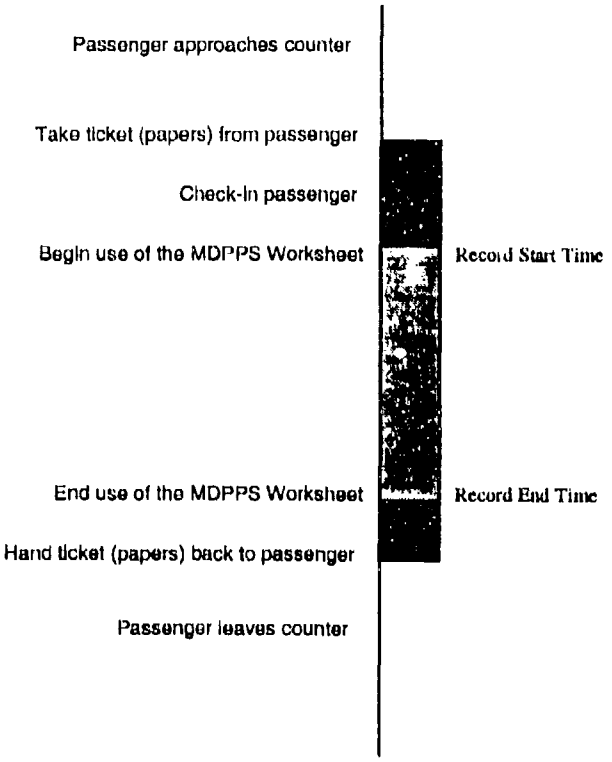
The items in the profile are the actual items proposed for the profile. If these items are known outside of the industry, then the validity of the tool will be harmed. Therefore, please keep the items which you have seen and used confidential.

In closure....

Again, thank you for participating. Once we complete the trials, your thoughts and opinions on the form, how it should be structured and administered, and even the items being looked for would be appreciated. We will do a post-trial interview, but should time get tight, or should thoughts occur to you after we leave Milwaukee, please forward them to your management, to Jay Dombrowski of Northwest Security in Minneapolis at (612) 727-7043, or to Jack Berkowitz of Galaxy at (609) 645-0900.

Timeline for Using the MDPPS Worksheet

The timeline below is a sample of "typical" operations. Note that you should complete the passenger check-in first, and then use the MDPPS worksheet. It may be possible for you to get practiced enough to use the worksheet while checking in a passenger. That is fine, just record the time when you first start marking the form. The assumption is that you will enter the flight and passenger name first, then get a screen to verify. Our time would begin when you read the screen and confirm that the person is checked in. Then when you examine the PNR for additional information, perform the profile.



APPENDIX B

Additional Analyses for Off-Line Data

Additional Analyses for Off-Line Data

A further analysis was conducted to determine the rate of clearance for the PNR & Ticket-Lift flights if only the PNR was used. The two flights which used the PNR & Ticket Lift were re-profiled using only the PNRs. These two flights were Northwest flight 377 with 65 passengers and flight 653 with 56 passengers, for a total of 121 passengers. The results of this analysis showed that the clearance rate declined substantially when passengers were re-profiled without using the ticket lift, from 67.8 percent to 42.1 percent (51 cleared out of 121 passengers; see Figure B-1). Combining the results of this analysis with the previous PNR Only analysis, the composite PNR Only clearance rate was 36.0 percent (82 cleared out of 228 total passengers).

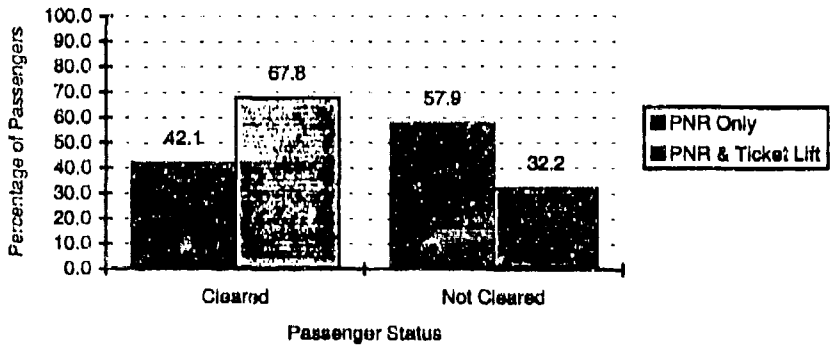


FIGURE B-1. CLEARANCE RATES FOR FLIGHTS 377 & 653 PROFILED OFF-LINE WITH AND WITHOUT THE TICKET LIFT.

APPENDIX C

Response of Northest Airlines Concerning MDPPS Resource Requirements

MANUAL DOMESTIC PASSIVE PASSENGER PROFILING SYSTEM (MDPPS)

ISSUE:
"DOES THE DOMESTIC PASSENGER PROFILING SYSTEM REQUIRE EXCESSIVE RESOURCE REQUIREMENTS?"

Response of Northwest Airlines

Executive Summary:

At issue is whether or not the Manual Domestic Passenger Profiling System (MDPPS) requires excessive resource requirements.

MDPPS is one of a series of contingency measures existing in the current AVSEC contingency plan. The resource requirements identified with it's implementation include:

- Resources relating to Northwest personnel.
  - $8,343,900/yr. salary and benefits for 150 new Customer Service Agents
  - $685,800/yr. salary and benefits during 30 days of training for new employees
  - An estimated 60-90 days in addition to the training period, to recruit, train, hire, and perform FAA required background and drug testing.
- Resources relating to Non-Northwest personnel.
  - $3,240,000/yr. for an estimated 150 security screeners.
- Resources relating to indirect factors.
  - $1,978,275 initial investment for equipment
  - 60-90 day period to obtain and install new equipment
  - Undetermined cost and time factors for facility modification

The above resource requirements are excessive because they make it impossible to keep MDPPS within the guidelines for good Crisis Management. Hence:

- MDPPS is not implementable in a timely fashion.
- MDPPS is not operationally feasible.
- MDPPS does not allow routine business to proceed.

- MDPPS measures are inconsistent with temporary relief.

The logical conclusion is that the estimated cost to the aviation industry of $109,599,807 unduly impacts air carrier resources and requires excessive monetary and personnel commitments.

I. Introduction:

In February of 1994 Northwest Airlines Inc. (Northwest) participated in the testing and evaluation of the Manual Domestic Passive Profiling System (MDPPS). The evaluation was conducted at Northwest's facilities in Milwaukee.

The Test and Evaluation Plan (TEP) for MDPPS has identified three issues crucial for proper evaluation of the system. Issue number three asks the question " Does the Domestic Passenger Profiling System Require **Excessive** Resource Requirements?" It is this issue which Northwest is responding to.

In order to properly answer this question it is first necessary to consider what the system is supposed to be. According to the TEP;

> *"An increase in threat conditions could result in a requirement for additional security precautions such as a positive passenger bag match or x-ray inspection of all baggage. These precautions are resource intensive; however their cost could be substantially reduced if the number of passengers needing special security measures could be minimized. This could potentially be accomplished by applying a passenger profile to identify domestic travelers thought not to represent a threat."*[1]

In addition it must be recognized that any Domestic Profiling System is in fact *only one* measure in an over all contingency plan and as such must follow accepted rules of Crisis Management. Crisis Management is admittedly not an exact science, however, some general guidelines for contingency measures can be stated.

- Contingency measures must be implementable in a timely fashion.[2]
- Contingency measures should be operationally feasible. The Plans provisions must be something that can be implemented within an existing system.[3]

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[1] Test and Evaluation Plan: Manual Domestic Passive Profiling System (MDPPS) FAA Technical Center, January 1994

[2] Aviation Security Contingency Plan - Change 39 to the Air Carrier Standard Security Plan.

[3] This principle can not be emphasized too greatly. In May 1992, the Joint Airports Association Council International (ACI) and International Air Transport Association (IATA) issued a joint position paper expounding on the subject. It stated in part "It must be emphasized that aviation security measures have an adverse effect on system capacity and

- Contingency measures should be drawn up so that *ROUTINE BUSINESS CAN PROCEED DURING THE CRISIS PERIOD* [4].

- A Contingency measure is intended to provide temporary relief, specific in scope.[5]

Our response to the issue of excessive resource requirements will first focus on listing the direct and indirect resources required for implementation of MDPPS. If it can be shown that the resource requirements make implementation of MDPPS inconsistent with the above principles of Crisis Management, then those requirements can rightly be called excessive. It is the view of Northwest Airlines that this is the case.

II. Resource Requirements Identified:

A. *Assumptions:*

- System wide implementation is even possible and would be attempted.
- Personnel and equipment costs will remain unchanged.
- Passive profiling would take no longer than 83 seconds per passenger average
- Off-line profiling without ticket lifts are not possible, due to logistic considerations since the ticket lift is created at the time the passenger boards the aircraft.
- Off-line profiling would not be done as it would not produce an acceptable "clear" rate.
- No "FAA Approved Profilers" would be required. Rather all security functions would be done by gate agents and normal screeners.

B. *Resource Requirements Relating to Personnel:*

- Past Northwest analysis of the issue of domestic profiling[6] have indicated the need for an estimated 150 additional Customer Service Agents in order to implement MDPPS on a system wide basis. A previous Northwest Airlines study showed the need for two or more

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facilitation: hence ...requirements (of the crisis management plan) should realistically match the threat as assessed. Governments need to consider the limitations of existing airport facilities in introducing new security measures: many older buildings were not designed for current levels of security and can not be effectively converted.

[4] See training guide entitled "Crisis Management" The Federal Bureau of Investigation, Special Operations and Research Unit, FBI academy, Quantico, VA. 1989

[5] See ICAAO Annex 17 3.11.2 Fourth Edition - 1992

[6] Personal correspondence, Jay Dombrowski to Bruce Butterworth, comments on proposed contingency plan, May 5, 1993

additional agents (profilers) at each of their 22 Hub Gateway and Class A stations as well as one additional agent (profiler) at 101 Class B and C stations (total: 150 additional agents (profilers)). Average hourly cost per new employee, which includes benefits, is $19.05. 150 persons for 8 hours a day at that rate of pay equals a cost of $22,860 per day, or $8,343,900 per year.

- The time required to recruit, interview, hire, and perform FAA required background check and drug testing, with existing Human Resources staff would be approximately 60-90 days.

- The new hire staff would require a minimum of 30 days training. Utilizing the above figures this represents a cost of $685,800.

C. *Resource Requirements Relating to Indirect Factors:*

The Manual Domestic Passive Profile System is a single contingency measure in a larger overall plan. As quoted in Section I. of this document, certain additional security precautions are anticipated for those who are not cleared by this profile. These additional precautions must be considered when attempting to determine if the system is too resource intensive for use.

- Security screening personnel would be required to provide additional screening. Previous studies have estimated that approximately 150 screeners would be needed to handle the additional responsibilities on a system wide basis. These 150 additional screeners would be needed for operating the 30 additional x-ray machines (see below) in shifts, seven days a week. Using an average wage of $7.5/hr implementation will require an investment of $9,000 per day or $3,240,000 per year. It will take an estimated 30 days to hire and train the necessary personnel to accomplish this task.

- Security equipment would be needed to provide additional screening functions.

  - Previous estimates have indicated the need for a $28,275 investment in handwands. Handwands cost approximately $195.00 per unit. Northwest Airlines has 22 Hub, Gateway, and class a stations which would require 2 handwands each, while 101 class B and c stations would require 1 unit each. This totals at 145 handwands at a cost of approximately $28,275.00.

  - Further, should the required "additional precautions" include the x-ray of checked luggage, it is estimated that Northwest will be

required to purchase at least 30 "system - 7" type x-ray machines costing approximately $65,000 each. This represents an investment of $ 1,950,000. This estimation is based on the assumption that 3 Hub and 5 Gateway stations would require, on a temporary basis, 2 additional x-ray systems each (total: 16 x-ray machines). The Class A stations would require 1 additional x-ray machine each (total: 14 x-ray machines).

- Modification to the facilities at some airports could possibly be required. This is especially true if a change from a "Concourse" to "Hold Area" screening plan was required due to additional precautions identified as being necessary. Estimates of resource requirements in this area are impossible since it includes items such as building permits, environmental studies, and capital funding. Implementation time in excess of a year is not unreasonable to expect.

III. Other Considerations:

- The MDPPS fails to consider the limitations of the Civil Aviation Industry when it comes to being able to muster such a vast amount of resources in today's environment. It must be remembered that revenue and cash flow are essential in order to fund any contingency plan. Revenue loss resulting as a consequence of this plan will have an effect on the ability of the airlines to fund long term countermeasures. Any determination of what constitutes "Excessive Resource Requirements" must consider the environment which is likely to both be the cause of as well as the result of these measures.

  - Based on the experience in the Gulf War, it can be expected that the industry will suffer an almost immediate reduction in passengers revenue of approximately 10%, or $731,402,700.00 per year.[7]

  - It is impossible to calculate the long term effects of such a contingency measure on the industry. Many passengers will no doubt continue to fly, however simply switch to a foreign carrier to avoid either the risk, or extra security procedures.[8] Some passengers leaving domestic carriers will never return.

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[7] Northwest Airlines total revenue passengers flown for year ending Dec. 31, 1993 was 44,120,769. Total Passenger Revenue Dollars for the same period was $7,314,027,000.

[8] See comments in the Presidents Commission on Aviation Security and Terrorism, Report to the President.

IV. Conclusion: the Manual Domestic Passive Profiling requires excessive resource requirements.

When consideration is given as to the impact that the above resource requirements will have on the contingency measure, it can be seen that it will become impossible to keep MDPPS within the guidelines of good Crisis Management. It can therefor be stated that the MDPPS is to resource intensive to serve the aviation industry.

- **MDPPS is not implementable in a timely fashion.**
  - The hiring and training time needed for additional staff preclude immediate implementation
  - Modifications to airport facilities could also affect implementation time.
  - Northwest Airlines has identified the need to purchase approximately 30 additional x-ray machines. Should there be a requirement to for x-ray all checked luggage the number could triple. Given the Northwest's 13% market share the number of x-rays needed to implement the system will exceed the 150 per month capacity of the entire US manufacturing industry.

- **MDPPS is not operationally feasible.**
  - The MDPPS fails to consider that many passengers arrive at the airport, with boarding passes in hand, previously issued by travel agents.
  - MDPPS fails to consider all additional measures which might likely be required for selectees. Many of these place constraints on the physical location within the terminal at which MDPPS could be performed.

- **MDPPS does not allow routine business to proceed.**
  - MDPPS could require the redefinition of the domestic passenger boarding process, and the elimination of curbside check-in and pre-issued boarding passes.
  - The elimination of pre-issued boarding passes would not only affect the airline but also approximately 24,000 domestic travel agencies.

- **MDPPS [illegible]re inconsistent with temporary relief.**
  - Purc[illegible]apital items such as x-ray machines are items more suited [illegible]sures intended to be permanent in nature.
  - It is poss[illegible]hat modifications to airport buildings and facilities would be required depending on the additional measures identified for selectees.

The Test and Evaluation plan for the MDPPS project states

"Airlines have limited financial and personnel resources and the MDPPS should not unduly impact their resources by requiring excessive monetary and/or personnel commitments."

Yet using the equipment and personnel costs outlined above (not lost revenue or other indirect costs), the first year cost to Northwest would be $14,247,975.00,[9] an increase of over 160% compared to 1993 expenses for passenger screening.

Clearly such an expenditure can be said to "unduly impact" air carrier resources, by requiring "Excessive Monetary and/or personnel commitments".

[9] Considering that Northwest's market share is roughly 13% the first year cost to the industry can be estimated at $109,599,807.00